3.0 TMDL ENDPOINT DETERMINATION

To meet the designated uses in the Christina River Basin, water quality targets, or *endpoints*, must be achieved under the variable flow conditions. The selection of these endpoints considers the water quality standards prescribed by those designated uses (Section 1-3).

Once EPA identifies the applicable use designation and water quality criteria, EPA determines the numeric water quality target or goal for the TMDL. These targets represent a number where the applicable water quality is achieved and maintained. In these TMDLs, the target is to attain and maintain the applicable DO water quality criteria at low-flow conditions. Figure 3-1 below shows the applicable use designations for stream segments included in the Christina River Basin TMDL. Using Tables 1-4 and 1-5 and Figure 3-1, the numeric water quality targets for DO can be identified for each segment. Table 3-1 below identifies the general water quality targets or endpoints for the Christina River Basin TMDLs.

Table 3-1. Summary of TMDL Endpoints

Parameter	Target Limit	Reference
Daily Average DO, warm water fish (PA)	5.0 mg/L	Pennsylvania Water Quality Standards
Daily Average DO, cold water fish (PA)	6.0 mg/L	Pennsylvania Water Quality Standards
Daily Average DO, fresh waters (DE)	5.5 mg/L	Delaware Water Quality Standards
Daily Average DO, cold water fish (DE)	6.5 mg/L	Delaware Water Quality Standards
Daily Average DO, tidal fresh waters (DE)	5.5 mg/L	Delaware Water Quality Standards
DO at any time, freshwater (MD)	5.0 mg/L	Maryland Water Quality Standards
Minimum DO, warm water fish (PA)	4.0 mg/L	Pennsylvania Water Quality Standards
Minimum DO, cold water fish (PA)	5.0 mg/L	Pennsylvania Water Quality Standards
Minimum DO, fresh waters (DE)	4.0 mg/L	Delaware Water Quality Standards
Minimum DO, cold water fish (DE)	5.0 mg/L	Delaware Water Quality Standards
Nitrate-Nitrogen	10 mg/L	PA and DE Water Quality Standards
Ammonia-Nitrogen	function(Tem, pH)	PA and EPA Water Quality Criteria
Total Nitrogen guideline (DE)	3.0 mg/L	DE 303(d) rationale document
Total Phosphorus guideline (DE)	0.2 mg/L	DE 303(d) rationale document

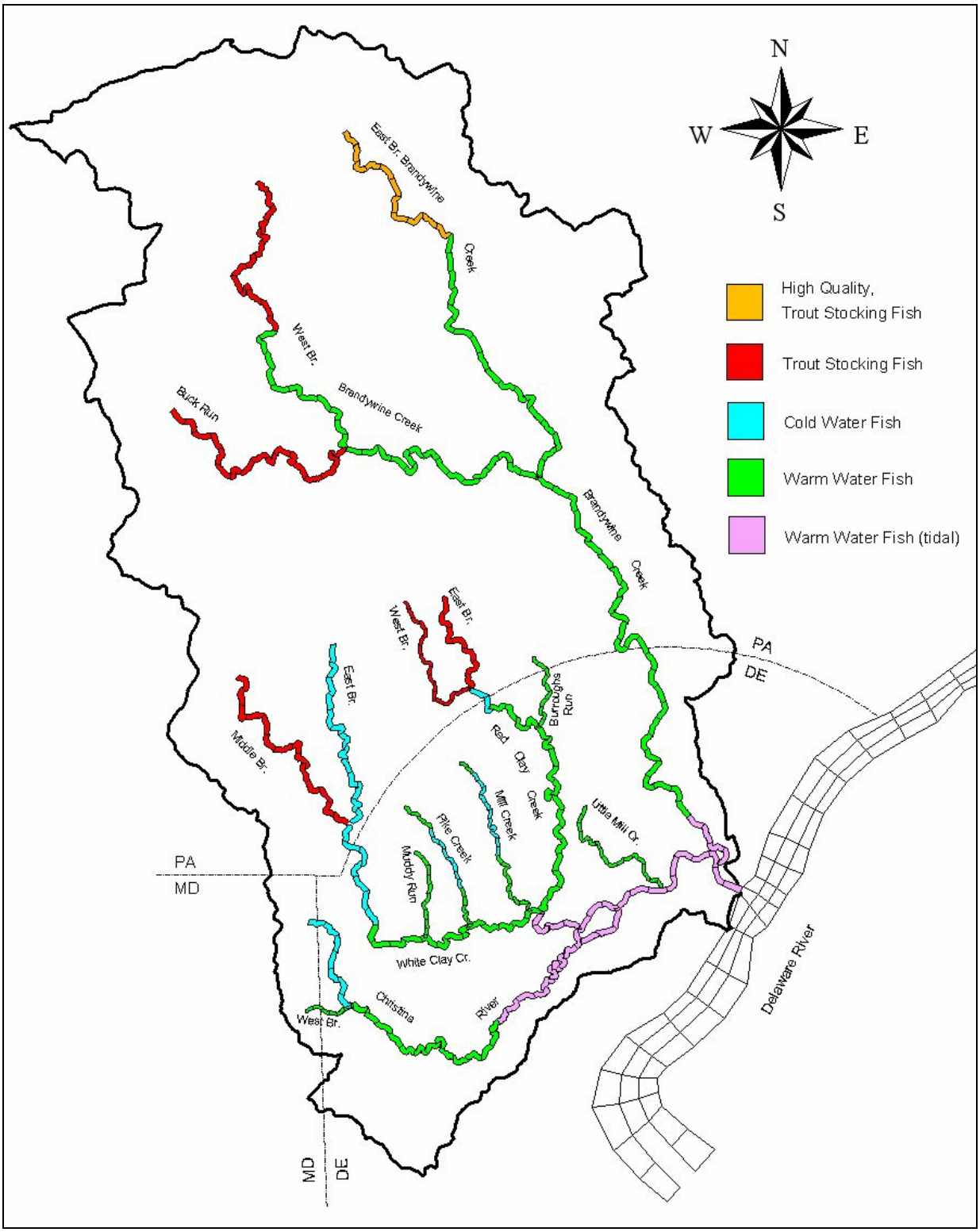

Figure 3-1. Use designations of streams included in the Christina River Basin water quality model

These TMDLs have also identified the pollutants and sources of pollutants that cause or contribute to the impairment of the DO criteria and allocate appropriate loadings to the various sources. Given our scientific knowledge regarding the interrelationship of nutrients, BOD, SOD and their impact on DO, EPA determined it necessary and appropriate to establish numeric targets for total nitrogen and total phosphorus based on applicable state narrative criteria to support the attainment of the numeric DO criterion and protection of aquatic habitat. Establishing numeric water quality endpoints or goals also provides the ability to measure the progress toward attainment of the WQS and to identify the amount or degree of deviation from the allowable pollutant load.

While the ultimate endpoint for the previous low-flow TMDL analysis was to ensure that the WQS for DO were maintained throughout the Christina River Basin, it is necessary to determine if other applicable water quality criteria are met and maintained. Specifically, this applies to the Pennsylvania WQS for nitrate-nitrogen of 10 mg/L and ammonia-nitrogen, which is based on temperature and pH. The Maryland WQS for ammonia-nitrogen adopted the EPA water quality criteria in January 2001 (see Table 1-6). As a result of the pollutant load reductions necessary to maintain the water quality criteria for DO, the WQS for nitrate-nitrogen and ammonia-nitrogen of Pennsylvania and Maryland were also evaluated. The ammonia-nitrogen standard is met throughout the Pennsylvania portion of the Christina River Basin. The only instances where the nitrate nitrogen value of 10 mg/L is exceeded are small distances on the East Branch Brandywine Creek and West Branch Brandywine Creek. As there are no drinking water withdrawals at these locations, the standard is not applicable and additional reduction is not necessary.

The Delaware WQS also set a numeric water quality criterion of 10 mg/L for nitrate-nitrogen. The WQS for nitrate-nitrogen of Delaware are met throughout the Delaware portion of the Christina River Basin. Delaware does not have numeric water quality criteria for ammonia nitrogen; however, the analysis indicates that ammonia-nitrogen levels throughout the Delaware portion of the Christina River Basin are consistent with the recommended EPA water quality criterion from Section 304(a) of the CWA.

Achieving these in-stream numeric water quality targets will ensure that the designated uses (aquatic life and human health uses) of waters in Pennsylvania, Delaware, and Maryland are supported during critical conditions.